

3.0 AFFECTED ENVIRONMENT

Much of the background information presented in this Chapter is taken from the 1998 Natural Resource Management Policy, 1997 Ecological Resource Management Plan for the Rocky Flats Environmental Technology Site, 1994 Rocky Flats Environmental Technology Site Environmental Report, 1994 Rocky Flats Plant Wetlands Mapping and Resource Study, and the 1992 Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at Rocky Flats Plant. More detailed discussions of many topics discussed below are found in the above-mentioned reports, and in the Rocky Flats Cleanup Agreement. The most current lists of vegetation and wildlife species for the entire Site can also be found at <http://www.rfets.gov/>. This Web site provides ecological information under the “Environmental Data” button, then the “Ecology” button.

As discussed in the preface, it is often impossible to discuss the affected environment of Rock Creek Reserve without discussing the background and environment of the region as a whole. The affected environment includes not only the remainder of Rocky Flats, but also the area extending from Standley Lake on the east to the foothills of the Rocky Mountains to the west. When appropriate, affected environment for the region and its relationship to Rock Creek Reserve will be discussed.

3.1 TOPOGRAPHY, PHYSIOGRAPHY, GEOLOGY AND SOILS

3.1.1 Topography and Physiography

The environment at Rocky Flats is influenced by the Site’s proximity to the Front Range of the Rocky Mountains and its location on a broad, eastward sloping plain of coalescing alluvial fans. As shown on U.S. Geological Survey maps, the Front Range trends north-south at elevations of about 9,800 feet above sea level, with elevations increasing to 13,000 feet along the Continental Divide about 16 miles west of Rocky Flats. The elevation of Rocky Flats varies from approximately 6200 feet at the western boundary to approximately 5650 feet at the southeastern corner. This suggests a gently sloping landscape. However, the Rock Creek Reserve, with a stream channel ranging from 6220 feet in the west to 5710 feet in the eastern portion, has slopes in the Rock Creek drainage that are the steepest of the three drainages located at the Site. Differences in the eroded depth of the three stream channels at the Site has resulted in formation of different soil-forming materials in Rock Creek than in Woman and Walnut Creeks, which have similar soils. Rock Creek’s steeper ravines have a southwest-to-northeast orientation, while the other two creeks have wider valleys that trend west to east. This difference in aspect and slope can influence soil moisture, and thereby the habitat for plant community formation. Minor rock outcrops occur largely in the Rock Creek section of the site. Scattered Ponderosa Pines are located on these outcrops.

3.1.2 Geology

Rock Creek Reserve is located just east of the Front Range in the Denver Basin – an asymmetrical, north-south trending syncline with a steeply dipping western limb and a shallowly dipping eastern limb. The Denver Basin contains more than 9,840 feet of Pennsylvanian to Cretaceous sedimentary deposits. Geologic units at the Site, including Rock Creek Reserve, consist of unconsolidated surficial material and bedrock. Cretaceous deposits of the Arapahoe Formation, Laramie Formation, and Fox Hills Sandstone are unconformably overlain by Quaternary alluvial gravels, colluvial deposits, and artificial fill. Fox Hills

and Laramie Formation sandstones form a prominent hogback that strikes north-northwest from Leyden Gulch north to the town of Marshall. Immediately west of Rocky Flats where the hogback is not visible, these sandstones are exposed in clay and gravel pits excavated through the Quaternary gravels. Soils are from several series, derived from surficial geologic formations.

3.1.2.1 Hydrogeology

The uppermost aquifer at the Site is comprised of the Rocky Flats Alluvium, valley fill alluvium, colluvium, bedrock sandstones, and weathered claystones of the Arapahoe and Laramie Formations. In general, groundwater in the uppermost aquifer occurs under unconfined conditions. Sitewide groundwater flow moves from the higher elevations in the west toward the lower drainages in the east. Sources of groundwater recharge to the uppermost aquifer include infiltration of precipitation, snowmelt, and surface water in ditches, streams and ponds. Discharge occurs through evapotranspiration from plants and as seeps when the table intersects the ground surface or surface water features such as streams, ditches, ponds or stream-eroded valleys. Groundwater levels at the Site rise annually in response to spring recharge and decline the remainder of the year as less precipitation occurs.

3.1.3 Soils

Soils at Rocky Flats are chiefly moderate to deep, well-drained clay, cobbly clay, and sandy loams, with moderate to low permeability. Soil types for the entire Site, including Rock Creek Reserve are shown in Fig. 3. Bottomland (floodplain and low terraces) soils are largely stratified loamy alluvium, made up of mesic Ustic Torrifluvents from the Haverson series. The Haverson series is well drained and commonly found on slopes of 0 to 9 percent. Soils of the terraces and upper hillsides, where gravel and cobble are common, are represented by combinations of the Denver and Kutch series. Both of these soils are well drained, deep (Denver) to moderately deep (Kutch), and are found on moderately steep slopes, 0 to 15 percent and 5 to 25 percent for Denver and Kutch, respectively. These mesic Torrtic Argiustolls are sandy loam formed from Rocky Flats Alluvium. Lower hillsides and areas toward the eastern boundary of the Site have soils from the Standley, Nunn, and Valmont series, which are largely mesic Ardic Argiustolls. These soils that vary in slope are deep and well drained. The slope for Standley, Nunn, and Valmont series are 0 to 60, 0 to 25 and 0 to 3 percent, respectively.

More information on the geology, hydrogeology, and soils of Rock Creek Reserve can be found in the 1991 Baseline Study for Rocky Flats and the 1995 Seepage Characterization Work Plan for the Rocky Flats Environmental Technology Site (EG&G, Rocky Flats Inc).

3.2 WATER RESOURCES

3.2.1 Surface Water/ Wetlands

Surface water flows from the Site via five streams which pass through or are adjacent to the Site. Three of these streams, North Walnut Creek, South Walnut Creek, and Woman Creek, contain detention ponds to protect neighboring cities' water supplies. Those creeks are part of the Big Dry Creek watershed. Rock Creek flows in a more northerly direction into Coal Creek off-site, and ultimately to the South Platte. The Industrial Area is located between two stream-cut valleys: North Walnut Creek and Woman Creek. This section focuses on the Rock Creek drainage.

Surface water originates from two main sources on Rock Creek Reserve. The most important sources for the formation and maintenance of the aquatic ecosystem are groundwater discharges that form springs and seeps in numerous places along Rock Creek. These seeps and springs are perennial discharges that augment stream flow and provide stable habitats for aquatic organisms and plant communities that require additional water resources. Surface water runoff also contributes water to the ecosystem; but, in the semiarid climate of the Front Range, precipitation is sparse, and the hot dry winds can evaporate water at the soil surface. The presence of perennial marshland and riparian communities greatly increases the plant and animal diversity of Rock Creek Reserve.

Section 404 of the Clean Water Act delegates jurisdictional authority over wetlands to the U.S. Army Corps of Engineers (Corps) and the Environmental Protection Agency (EPA). The EPA is the lead agency, however, at CERCLA sites such as Rocky Flats. The Corps of Engineers and the EPA jointly define wetlands as “...areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas”.

Wetlands on Rock Creek Reserve and the rest of the Site are not rare or unique, but the large amount of seep/spring related wetlands in the Buffer Zone are rare along the Front Range of Colorado. These wetlands serve valuable and important functions, as do wetlands everywhere. They perform the role of a water purification system by retaining nutrients, sediments, and metals. They also provide forage, cover, and nesting habitat, which is very important in maintaining wildlife values. Figure 4 shows the location of Site (including Rock Creek Reserve) wetlands.

The 6,266-acre Site has approximately 1,100 wetlands covering approximately 191 acres that were identified and mapped in the 1994 Rocky Flats Plant Wetlands Mapping and Resource Study, U.S. Army Corps of Engineers. These wetlands include riparian (streamside) habitat, ponds, seeps, and hillside wetlands. Riparian areas are well known for the diversity of plant and animal communities they support. The Site Great Plains Riparian Woodland complex encompasses three vegetation community types, and provides important habitat for numerous songbird species, deer, and raptors, in addition to supporting the greatest number of the federally-listed, threatened Preble's meadow jumping mouse at the Site. The sustained quantity and timing of streamflows is required to support the riparian communities.

The 1994 Wetlands Mapping and Resource Study identified 25.4 acres of stream wetlands, and 32.2 acres of slope (seep) wetlands for a total of 57.6 acres of wetlands for Rock Creek and its subdrainages. Rock Creek was identified in that study as a high quality wetland based on the biodiversity of the wetlands. The largest, best watered, and most diverse of the slope wetlands are located in the Rock Creek and Woman Creek watersheds according to the study. The only significant manmade drainage feature on Rock Creek within the Reserve is the Lindsay Pond, used as a stock-watering pond prior to 1974, by the Lindsay Ranch. Other wetlands on Rock Creek Reserve are primarily associated with seeps along the northern slopes.

3.2.2 Groundwater

Groundwater at Rocky Flats, including Rock Creek Reserve, is relatively small in volume and slow to move, hence, slow to move off the Site. Rock Creek Reserve is unaffected by groundwater contamination, which moves in a southeasterly direction from the Industrial Area. The closest groundwater contamination plume to Rock Creek Reserve is the Property Utilization & Disposal plume, from a previous sanitary landfill, located south of Rock Creek Reserve. This plume, contaminated with volatile organic compounds (mainly solvents), migrates south and east, away from Rock Creek Reserve.

There are a number of small near-surface groundwater reservoirs, which feed important ecological features, such as upland wetlands. Upland wetlands include primarily wet meadow/marsh ecotone and the tall and short marshes. Groundwater seeps support the tall upland shrubland in Rock Creek Reserve.

3.2.3 Water Quality

The groundwater and surface water quality in Rock Creek Reserve is considered good. Supporting data can be found in “Event-Related Surface-Water Monitoring Report, EG&G, September 1994. Section 2.1.7 describes additional contamination related issues for Rock Creek Reserve. Sampling outlined in Section 4.2 may determine if there are any impacts to Rock Creek affecting groundwater and/or surface water quality.

3.3 CLIMATE AND AIR QUALITY

3.3.1 Climate

Typical of the Rocky Mountain Front Range, the climate at Rocky Flats is continental and semiarid. A climate is termed “continental” when the most profound influences on temperatures are determined by the air masses that form over the interior of the continents, in this case, North America. Frigid air masses that form over the Northwest Territories and central Canada, Alaska, and Siberia in winter occasionally affect eastern Colorado. During the summer months, very warm air masses form over the deserts and high plateaus of the southwestern United States. These air masses account for the hottest days along the Front Range. Continentality accounts for the large seasonal temperature variations and, in part, for the occasionally large temperature changes over short periods of time experienced at Rocky Flats.

In addition to the continental climate, the Site’s sloping geographical location and its proximity to a major mountain range permit dramatic changes in temperature and rapidly changing weather conditions. The location of Rocky Flats can also work to moderate the otherwise continental climate. Air masses approaching from the west and descending the eastern slope of the Continental Divide are warmed and dried out upon reaching the foothills and adjacent plains. These situations result from a strong pressure differential that develops across the Continental Divide, between low pressure over the plains and high pressure building over the Great Basin.

Large centers of high pressure build over the Great Basin and central Rockies and frequently dominate weather along the Front Range with dry and sunny periods, especially in autumn and mid-winter. On average, the number of days with fair and dry conditions at Rocky Flats generally exceeds the number of

days with inclement weather. It is not uncommon to see a month of dry and mostly clear days when large areas of high pressure build over the intermountain region.

3.3.1.1 Precipitation and humidity

The lower elevations of the Front Range, including Rocky Flats, are considered semiarid because of the relatively small amount of precipitation received. A semiarid climate has a precipitation range of 10 to 20 inches per year and/or an amount exceeded by potential evaporation and transpiration. Rocky Flats receives approximately 15 inches of precipitation each year. Of this amount, 70 percent usually falls in April through September. Thunderstorms occur about 40 days each year, mostly in summer. The average seasonal snowfall is about 65 inches. Great distances from a major water source and shadowing and downsloping from the Rocky Mountains are the primary reasons for the semiarid climate of the Front Range. Severe drought conditions will develop occasionally along the Front Range during unusually prolonged dry periods. These conditions often lead to wildfires in the prairies, which sometimes affect the Buffer Zone, including Rock Creek Reserve and other surrounding areas

The average relative humidity in mid-afternoon is about 40 percent. Humidity is higher at night, and the average at dawn is about 60 percent.

3.3.1.2 Temperature

Temperatures in the region are moderate with hot and cold extremes usually of short duration. The thin atmosphere at the relatively high elevation of Rocky Flats allows large diurnal temperature variations, with strong daytime warming and nighttime cooling. The historic temperature extremes have ranged from 29 degrees below zero (all temperatures are expressed in degrees Fahrenheit) in February 1989 to 102 degrees in July 1971. January, the coldest month, has an average daily minimum temperature of 18 degrees. Average daily temperatures in winter range from 20 to 45 degrees. July, the hottest month, has an average daily maximum temperature of 85 degrees. Average daily temperatures in summer range from 55 to 85 degrees, though short periods may be much hotter. The temperature range affects the plant growing season, the number of consecutive days when minimum daily temperatures exceed the freezing point from spring until fall. At Rock Creek Reserve the growing season can be expected to continue from mid-May to the end of September during 50 percent of the years.

3.3.1.3 Winds

The combination of clear skies, light winds and sloping terrain causes locally produced winds to form and flow along sloping terrain. Daytime heating causes upslope breezes to form either southeasterly winds which flow up the Rocky Flats slope, or northeasterly winds which flow up the South Platte River Valley. Winds reverse at night with a shallow northwest wind draining down the Rocky Flats slope.

During winter and early spring, downslope winds, known as chinooks, often produce strong westerly winds and large and rapid temperature increases. On occasion, chinooks can be damaging and dangerous but generally are just a temporary nuisance. Wind gusts will typically exceed 70 miles per hour a few times in a normal year. Peak gusts have been measured over 100 miles per hour.

3.3.2 Air Quality

National Ambient Air Quality Standards have been established to protect public health and the environment for six “criteria” pollutants: carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, particulate matter less than 10 microns in size (PM-10), and lead. Total suspended particulate (TSP) matter is also designated as a criteria pollutant by the State of Colorado. This Plan is primarily concerned with PM-10 and TSP emissions since they are the pollutants likely to be generated from management practices on Rock Creek Reserve.

Rock Creek Reserve is located within the boundary of the Denver Metropolitan Area for air quality planning purposes. This region is classified as “non attainment” for carbon monoxide, ozone, and PM-10, which means that the ambient air quality in the area does not meet National Ambient Air Quality Standards. Regulatory requirements may control the timing of certain natural resources management activities, such as prescribed burning, which requires a permit from the State. This helps to avoid contributing to the non-attainment of the Metro area and violating the Site’s air quality permit.

Concentrations of TSP and PM-10 are determined by five air monitoring stations at the site boundary and are operated by the Colorado Department of Public Health and Environment. These stations monitor PM-10 and TSP as well as other criteria pollutants. Two of these stations are located just off-site at the northeast and southeast site boundary along Indiana Street. These sampling locations are downwind of Rock Creek Reserve and are thus representative of Site impacts. All criteria air pollutants are emitted from the Site in quantities less than the State of Colorado reporting thresholds under baseline conditions.

3.4 VEGETATION

The following sections present species information that has been observed the past nine years during monitoring and other routine activities within the Rock Creek drainage basin.

The distribution and composition of vegetation in the region has been affected by a series of natural and human-caused disturbances, including intense grazing until the land was acquired by DOE in 1974, natural fire suppression, and adjacent ground disturbing activities. Large areas of grassland have been invaded by diffuse knapweed and dalmatian toadflax over the past ten years (1999 Annual Vegetation Report for the Rocky Flats Environmental Technology Site). Other native grassland areas and riparian areas have been invaded by several species of exotic plants.

3.4.1 Vegetation Types

The uniqueness and diversity of the plant communities of Rock Creek Reserve are indicative of the entire Site, and have been documented by a number of studies. The topography and close proximity of the Site to the mountains has resulted in an interesting mixture of prairie and foothills plant communities at the Site. Federal threatened or endangered plant species are not known to occur on Rock Creek Reserve, or anywhere else at the Site. Plant communities range from xeric (dry) grassland communities to more hydric (wet) communities such as wet meadows and marshes.

Rocky Flats plant communities include:

- xeric tallgrass prairie (a large portion of which occurs on Rock Creek Reserve);
- xeric needle-and-thread grass prairie ;
- mesic mixed grassland;
- reclaimed mixed grassland;
- shortgrass prairie;
- grassland composed of annual plants;
- wet meadow-marsh ecotone;
- short marsh and tall marsh;
- both short and tall upland shrublands (most of which occur on Rock Creek Reserve);
- Savannah shrublands;
- several types of riparian (stream bank) shrublands.
- riparian woodland, ponderosa pine woodland; and
- mudflats.

Figure 5 shows the various vegetation types and distribution for the entire Rocky Flats site. Rock Creek Reserve (current) and Rock Creek Reserve expansion (proposed) are demarcated on the map.

3.4.2 Vegetation Inventory

In developing the Rock Creek Reserve plant species list, only those plants that were identified to species (415 species), and confirmed against the Site's reference herbarium, are included in the species list in the 1999 Annual Vegetation Report for the Rocky Flats Environmental Technology Site. This list is based on the 800 acre boundary for the Reserve, and will be updated to include the expansion. By growth form, there are 86 grass species, 283 forbs, 2 vines, 5 cacti, 22 shrubs, and 17 tree species. Of the species recorded in Rock Creek Reserve, 81% (337) are native to the area. Species found in Rock Creek Reserve are listed in Appendix 4.

The Colorado Natural Heritage Program (CNHP) assessed the Buffer Zone for its ecological value (The Natural Heritage Resources of the Rocky Flats Environmental Technology Site and Their Conservation, Phase II: The Buffer Zone [CHNP Research Report No. 53, 1996]). The CNHP is a research entity of the Nature Conservancy housed at Colorado State University's College of Natural Resources. Natural Heritage programs across the country are part of an international network of conservation data centers. The CNHP study concluded the Site contains highly significant natural elements important for the protection of Colorado's natural diversity and encourages DOE to take actions to protect and appropriately manage the Site.

3.4.3 Plant Communities

The CNHP identified the plant communities of greatest ecological significance on Rock Creek Reserve, and the entire Site, as the xeric tallgrass prairie, the Great Plains riparian community, the tall upland shrubland community, and wetlands. Distributions of these and other plant communities are shown in Fig 5.

Xeric tallgrass prairie. The CNHP classifies the xeric tallgrass prairie plant community at the Site as very rare. Most of the remaining xeric tallgrass prairie in Colorado is found in Boulder and Jefferson

counties in small, dispersed parcels. The CNHP report on Site natural heritage resources identifies the Site macrosite as the largest known remnant of xeric tallgrass prairie in Colorado, and probably the largest remaining parcel in all of North America. Macrosites provide boundaries for large, landscape level conservation planning, which includes areas adjacent to Rock Creek Reserve. A community comprised of big bluestem, little bluestem, mountain muhly, Fendler sandwort, and Porter's aster, less than 20 occurrences of the xeric tallgrass prairie are known worldwide. Approximately 1,800 acres of this xeric tallgrass prairie unit is within Rocky Flats' boundaries. About 56% of the site's xeric tallgrass prairie falls within the Rock Creek Reserve proposed expansion.

Great Plains riparian community. Identified by CNHP as Great Plains Riparian Woodland, this community is classified as rare and declining. It is characterized by a diverse mixture of plains cottonwood, peach-leaved willow, and coyote willow. Examples of this community are found in the Rock Creek, Walnut Creek, Woman Creek, and Smart Ditch drainages. The Great Plains riparian community also includes the communities described in the following sections. The riparian shrubland communities normally exist as an integral part of woodlands throughout the Great Plains.

Riparian shrubland. Two types of riparian shrubland are often found in association with the Great Plains Riparian Woodland community at the Site. These communities are dominated by leadplant or by coyote willow, and provide important habitat for many of the bird and mammal species found here, including the Preble's meadow jumping mouse. Combined with the Great Plains riparian community, these habitats support a prey base for many Site birds of prey, such as prairie falcons, great horned owls, screech owls, and red-tailed hawks.

Tall upland shrubland. The tall upland shrubland community is found on north-facing slopes primarily in the Rock Creek drainage. This community commonly occurs just above wetlands and seeps. The dominant tall shrubs are hawthorne, American plum and choke cherry, which are associated with other shrubs and plants common in the foothills to the west of the Site. Rock Creek Reserve harbors 94% of the tall upland shrubland plant community at Rocky Flats. Although the tall upland shrubland represents less than 1 % of the total area of the Site, it contains 55 % of the Site Vegetation species. In 1996, 333 species of vascular plants were recorded there. The herbaceous understory contains a number of species that are restricted to the cool, shaded microhabitat provided by the canopy. Many of these native species are predominant in the understory of the largest patches of tall upland shrubland on the Site. Their presence may indicate that these patches were affected less by past cattle grazing, or that they have returned to a more native state since the cessation of grazing. These native species include Fendler waterleaf, spreading sweetroot, anise root, carrionflower greenbriar, fragile fern, Colorado violet, Rydberg's violet, and northern bedstraw. Other studies reveal that the tall upland shrubland contains one of the highest species richness of birds on the Site and is very important as bird and other wildlife habitat, providing food, thermal and hiding cover, nesting locations, and deer fawning areas.

The tall upland shrubland was identified by the CNHP as a potentially unique shrubland community, possibly not occurring anywhere else. This community is used by many animals and birds throughout the year for cover and is used during the spring by mule deer as fawning areas. Several rare bird species, such as chestnut-sided warbler and blue-gray gnatcatcher, also inhabit this community during the breeding season. It is within this community that the globally rare (CNHP designation) hops blue butterfly has been observed, due to the abundance of wild hops growing there.

Other. Although some of the plant communities, such as the mesic mixed grasslands of the eastern

portion of the Site (and Rock Creek Reserve) are not rare, they add important buffer areas and habitat elements to the Site ecosystem. The grasses in this community are turf-like, with different species (western wheatgrass, Kentucky bluegrass, blue grama, green needlegrass and Canada bluegrass) intermingling in a nearly continuous ground cover. The mesic grasslands on the south-facing hillsides provide important forage for mule deer in the winter. Large tracts of grasslands provide essential habitat to several prairie species. Mesic mixed grasslands cover approximately 55 percent of the entire Site, mostly in the Walnut Creek and Woman Creek watersheds. Mule deer are very dependent on these grasslands at certain times of the year, many raptor species depend on open grasslands for foraging areas, several species of prairie birds rely on these grasslands as nesting and foraging habitat, and several species of reptiles require this habitat as well.

3.4.4 Noxious Weeds

Noxious weed invasions are considered the foremost threat to the native plant communities of Rock Creek Reserve by the CNHP, Service and DOE. These weeds inhabit the understory of the tall upland shrubland, the riparian woodland, and have invaded the prairie grasslands. Control of noxious weeds is arguably the most important component of any natural resources management program for the Rock Creek Reserve. The native fauna, from the large herbivores to the invertebrates that depend on these plant communities, are directly affected by impacts to these areas. Predators that depend on these herbivores are indirectly affected by these adverse impacts.

Ten years ago, there was little diffuse knapweed in the Buffer Zone; now, this Colorado-listed noxious weed inhabits more than 60 percent of the Buffer Zone. Noxious weeds are defined by the State as exotic, aggressive plants that invade native habitat and cause adverse economic or environmental impacts. Typically, these exotic plants are resistant to the native plant predators and tolerant of or resistant to grazing. These weeds can displace native plant species by taking nutrients, water, light, and space from native vegetation. Invasion of these aggressive, damaging plants poses a serious threat to Rock Creek Reserve and remaining Buffer Zone plants and animals that depend on native plants.

Several species of noxious weeds are found in Rock Creek Reserve, as representative of the rest of the Buffer Zone. The presence of these weeds is a regional and sometimes national problem. Several species of these weeds are found across the entire region and are spreading rapidly, especially in disturbed areas. These weeds are highly aggressive and are contributing to the degradation and loss of native species richness and composition in the plant communities. Weed species on Rock Creek Reserve and the rest of the site and region include diffuse knapweed, musk thistle, dalmatian toadflax, Canada thistle, and St. Johnswort. Diffuse knapweed, an aggressive tumbleweed, is currently given highest control priority. Canada thistle is common throughout most of the wetlands, musk thistle is sparse but widespread across mesic grasslands, and dalmatian toadflax is common in xeric grasslands and other areas.

The three most abundant noxious weeds on the Site as identified in the 1999 Annual Vegetation Report were dalmatian toadflax, infesting 2,507 acres (Fig. 6), diffuse knapweed infesting 2,295 acres (Fig 7) and musk thistle, infesting 1,353 acres (Fig 8).

3.4.5 Sensitive, Threatened and Endangered Species

In addition to those sensitive plant communities already discussed in this section, a list of plant species and communities and wildlife species found on Rock Creek Reserve defined as “sensitive” by the CNHP,

or listed as threatened or endangered by the State or federal government is found in Appendix 7. CNHP rankings and a definition of those rankings are included. This list shows sensitive species found on the rest of the Site also, since most of these species are found regionally or are highly mobile (faunal species) and migrate across the Site as well as off the Site.

No federally-listed plant species have been documented on Rock Creek Reserve. Several listed species have the *potential* to occur on Rock Creek Reserve (i.e., suitable habitat occurs and the species are found elsewhere in the region), including Ute Ladies' Tresses Orchid and Colorado Butterfly Weed.

3.5 FAUNA

Rock Creek Reserve's significant wildlife diversity is directly related to the habitat diversity in the region. The wildlife species richness list for the Rock Creek drainage (Appendix 5), was derived from compiling a species list from all ecological surveys, including fortuitous sightings, from 1991 through 1999. From all years and all studies, 171 wildlife species have been recorded in Rock Creek. Several of these records may have been only single observations. Broken down by general taxa, there are 28 mammal species, 134 bird species, 6 herptile (reptile and amphibian) species and 3 fish species. The information for this section was collected from the 1999 Rocky Flats Environmental Technology Site Annual Wildlife Survey Report. A list of fauna species found for the entire Site can be found in the 1992 Baseline Characterization of Terrestrial and Aquatic Habitats at Rocky Flats Plant.

No federally-listed, threatened or endangered fish, reptile, amphibian or invertebrate species are known to occur on Rock Creek Reserve, or the rest of the Site.

3.5.1 Mammals

The most abundant and conspicuous large mammals on Rock Creek Reserve include mule deer, several white tail deer, and Rocky Mountain elk. The coyote is the most common predator, with other carnivores including black bear, bobcat, gray fox, long-tailed weasel, mink, mountain lion and raccoon. Many small mammals are recorded (mice, shrews, voles and woodrats), most notably the federally-listed, threatened Preble's meadow jumping mouse. The black-tailed prairie dog does not occur currently on Rock Creek Reserve, but is found in small numbers at three former colony sites elsewhere at Rocky Flats. These populations are rebounding from a plague die-off that affected the populations several years ago. The bushy-tailed woodrat was recorded on the Site, but not on Rock Creek Reserve, for the first time in 1999.

3.5.2 Birds

The species richness list at Appendix 5 documents 134 species of birds from Rock Creek Reserve. The rare and varied habitat associations of Rock Creek Reserve support ground nesting grassland species, such as vesper sparrow, grasshopper sparrow, horned lark and western meadowlark.

Rock Creek Reserve's most common raptors are the red-tailed hawk and great horned owl. Less abundant raptors are attracted by the mosaic of trees for nesting and open habitat for hunting. These include American kestrel, Swainson's and ferruginous hawks (considered declining species by the Colorado Division of Wildlife), and the long-eared owl.

The orange-crowned warbler, great egret, and black vulture were recorded on the Site for the first time in 1999. The orange-crowned warbler was recorded in both Woman creek and Rock Creek.

3.5.3 Fish

Three species of fish are known to occur in Rock Creek and Lindsay Pond. These are the fathead minnow, largemouth bass, and stoneroller. The minnow and stoneroller are native to the area.

3.5.4 Reptiles and Amphibians

As is typical for the region, reptiles and amphibians are not well represented at the Site. Reptiles are found typically in the grasslands. The most abundant amphibian at the Site is the boreal chorus frog. The northern leopard frog is less common and requires perennial water, and can be found in the seeps of the tall upland shrubland, Great Plains riparian, and the ponds.

Six species of amphibians and reptiles are documented in the 1999 Annual Wildlife Survey Report to occur on Rock Creek Reserve. These are:

- Boreal chorus frog
- Northern leopard frog
- Tiger salamander
- Bull snake
- Prairie rattlesnake
- Western painted turtle

3.5.5 Invertebrates

Sampling of arthropods was conducted as part of the 1992 Baseline survey for the Site. Sampling was broken down into plant community sampling units. The following are the results taken from the important plant communities on Rock Creek Reserve. Percentages are expressed as percentage of the total sampled. It is expected, however, that most invertebrates found in any area of Rocky Flats would likely be found to some extent in all the others. The following are quantified as percentages of the total for all arthropods observed or collected.

Xeric tallgrass prairie – Terrestrial arthropod taxa in the xeric mixed grasslands community showed the lowest diversity compared to all communities. This results from the drier environment found in the xeric zone. The numbers of orders and families in the xeric zone were lower than site-wide community averages for arthropods. The most abundant insect families collected were Cicadellidae (leafhoppers, 19 %) and Formicidae (ants, 15 %). These two insect families include species specifically adapted to the drier habitats found in the xeric zone. Leafhoppers are generally plant-specific feeders and, therefore, have specialized relationships with plants found in this community. Arachnida (spiders, 12 %) were also well represented.

Tall upland shrubland – The diversity of arthropod taxa, both orders and families, was average for the tall upland shrubland when compared to all communities. Once again, the leafhopper family was the most abundant (15 %), followed by spiders (10 %). This community has several plant species that are

dependent on the bees, wasps and butterflies for pollination. The fruiting shrubs, such as chokecherry, wild plum and hawthorn, must be pollinated to produce fruit and viable seeds. The reproduction of these species depends on both the pollinators and the species that eat their fruits and scatter seeds.

Rare and imperiled invertebrates as defined by the CNHP have been observed on Rock Creek Reserve. Two species of Lepidoptera have been observed, the Arogos skipper and the Hops blue butterfly. The Hops blue larvae feed on the hops found growing in the tall upland shrubland.

Riparian woodland and shrubland – The riparian woodland had the greatest diversity of arthropod taxa and the largest number of families. This community complex also produced the largest total number of individuals. Once again the most abundant family was the leafhoppers (43 %). Hollows in the rotted heartwood of several old cottonwood trees provided hive sites for honeybee colonies.

The bottomland shrubland is dominated by leadplant with some shrubby willows intermixed. Taxon richness was average for terrestrial arthropods, as was the number of orders. The number of individuals was relatively low indicating a low abundance of arthropods. Leafhoppers led the pack again, accounting for 37 % of all arthropods collected.

Benthic macroinvertebrates were also sampled across the entire Site. Benthic macroinvertebrates, mostly larval stages of insects, are important members of the aquatic community because they have many functional roles. These species have relatively long life cycles (6 months to two years) and are a major food source for fish. Adult stages of aquatic insects are terrestrial. There were 155 taxa of benthic macroinvertebrates collected at the Site, including Rock Creek. The most abundant orders were Diptera (flies, 76 taxa), Trichoptera (caddis flies, 16 taxa), Coleoptera (beetles, 16 taxa) and Ephemeroptera (mayflies, 11 taxa). Several of these taxa are found only in clean water. The presence of so many taxa of caddis flies is a good water quality indicator, and can be used in the future as a baseline for water quality sampling on Rock Creek Reserve.

3.5.6 Sensitive, Threatened and Endangered Species

A list of wildlife species and plant communities found on Rock Creek Reserve defined as “sensitive” by the CNHP, or listed as threatened or endangered by the State or federal government is found in Appendix 7. CNHP rankings and a definition of those rankings are included. This list shows sensitive species found on the rest of the Site also, since most of these species are highly mobile and migrate across the Site as well as off the Site. These include the northern leopard frog, ferruginous hawk, black-crowned night heron, grasshopper sparrow and the loggerhead shrike. Only those listed “threatened or endangered” by the federal government are described in this section.

No federally-listed, threatened or endangered fish, reptile, amphibian, or invertebrate species are known to occur on Rock Creek Reserve, or the rest of the Site.

Preble’s Meadow Jumping Mouse

Rock Creek Reserve, along with all other main drainages that cross Rocky Flats, contains populations of, and habitat for, a resident federal threatened species, *Zapus hudsonius preblei*, the Preble’s meadow jumping mouse (Fig. 9). The mouse was listed as a threatened species on May 13, 1998 (63 FR 26517). No other federally listed mammals have been identified on Rock Creek Reserve. Preble’s meadow

jumping mouse, a member of the jumping mouse family Zapodidae, is a federally-listed, threatened subspecies. This mouse is a small mouse of about 3.5 inches body length with a disproportionately long tail of 5.8 inches. The pelage is dark where the dorsal band runs down the back, olive yellow on the sides and white underneath with no dark dividing band. Approximately 70 individuals have been estimated as living in the Rock Creek drainage. Preble's occurs in habitat adjacent to streams and waterways along the Front Range of Colorado and southeastern Wyoming. According to the documentation accompanying the proposed USFWS 4(d) rule, the subspecies' habitat is the riparian zone, primarily defined by the 100-year floodplain, and adjacent uplands extending out about 100 meters (Environmental Assessment for a Proposed 4(D) Rule on the Prebles's Meadow Jumping Mouse, USFWS). Based on actual habitat and trapping data, however, Site ecologists have established Preble's Mouse Protection Areas according to Site-specific habitat conditions (Preble's Meadow Jumping Mouse Protection Policy for Rocky Flats Environmental Technology Site, DOE, September 2000).

The Site has prepared and implemented the above-mentioned Protection Policy for the Preble's meadow jumping mouse. The Preble's Protection Policy (Appendix 6) and other protection policies, plans, and procedures will be evaluated to determine whether implementation may need to be improved, and whether modifications are needed in light of new information, developments, or related conservation efforts, including off-site studies and identified data gaps.

Bald Eagle

The bald eagle was federally-listed endangered in most states but was reclassified as threatened because of significant increases in the number of breeding pairs (USFWS, 1995). The USFWS has considered de-listing the Bald Eagle, and data are currently being collected to analyze this decision. No breeding pairs of eagles nest on Rock Creek Reserve, although they have been observed traversing the Reserve.

Bald eagles generally nest near water in forest stands that contain a mixture of tall, old, and dead or dying trees. An active nest is located to the east of the Site near Standley Lake. In winter bald eagles may expand their home range in search of food or migrate to areas where food is available. Bald eagles are known to congregate at reservoirs, lakes, or rivers. Availability of roosting habitat is an important component of the eagle winter ecology. Roosting habitat consists of trees that extend above the forest canopy and provide a protected microclimate for resting eagles. Eagles feed primarily on fish and waterbirds but also on small mammals and mammal carcasses. Some eagle populations are migratory, whereas others remain near their breeding areas year-round.

American Peregrine Falcon

In 1995 Peregrine falcons were proposed for removal from the list of endangered and threatened wildlife. Peregrine falcons were subsequently de-listed in 1998. Peregrine falcons have been observed traversing and resting on Rock Creek Reserve.

3.6 CULTURAL RESOURCES

A cultural resource is any locality or object exhibiting evidence of prior human behavior. Cultural resources generally comprise specific locations at which one or more activities occurred in the past, and which were visibly modified in the process (e.g., through the building of structures or other non-portable

features; modifications of the ground surface such as wagon ruts; or abandonment of portable items such as tools or refuse, i.e., artifacts). Cultural resources consist of prehistoric and historic buildings, sites, structures, districts, objects or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources may be any age, although generally they must be more than 50 years old to be considered for protection under existing cultural resource laws.

3.6.1 Archeological Resources

Surveys to locate cultural resources have been conducted over the entire acreage of the Site Buffer Zone. Two archeological surveys were conducted, one in 1989 (An Archaeological and Historical Survey of Selected Parcels Within the Department of Energy, Rocky Flats Plant, Northern Jefferson County, Colorado, Burney & Assoc. Inc, 1989) and in 1991 (Cultural Resources Class III Survey of the Department of Energy Rocky Flats Plant, Northern Jefferson and Boulder Counties, Colorado, Dames and Moore, 1991). While the surveys identified points of local interest in the Buffer Zone, such as Lindsay Ranch in the Rock Creek Reserve, no sites or artifacts eligible for listing on the National Register of Historic Places were found in the Buffer Zone. A total of 35 archeological sites and 29 isolated finds (usually one or two artifacts) have been recorded in the Buffer Zone. Identified archeological sites include stone rings and alignments, the remains of ranch buildings, trash dumps, stock ponds, corrals, irrigation ditches, an orchard, and a railroad grade. Isolated finds include chipped and ground stone artifacts, barbed wire, stone cairns, and pieces of farm equipment. Resources found during these surveys were primarily historic Euroamerican resources; Native American resources are rare at the Site. None of the sites or isolated finds in the Buffer Zone have been determined eligible for listing in the National Register of Historic Places. The Colorado State Historic Preservation Office (SHPO) concurred with the findings, and no special management or protective actions are required for these resources.

3.6.2 Historic Resources

A survey of the industrial area was prepared in 1995 and reported in the Cultural Resources Survey Report for the Rocky Flats Environmental Technology Site Industrial Area. The survey report concludes several of the facilities in the industrial area are of historic importance because of the role they played in the Site's contribution to the Cold War. Sixty-four facilities in the industrial area have been included in a historic district on the National Register of Historic Places. A Programmatic Agreement regarding the cleanup and closure activities at the Site between the Advisory Council on Historic Preservation, the SHPO, and DOE governs how Site historic information is being recorded.

3.6.2.1 Lindsay Ranch

The Lindsay Ranch, comprised of an old ranch house, barn, stock pond and fences, was evaluated for eligibility to the Register of National Historic Places and was determined to be ineligible, with SHPO concurrence. Description of the Ranch and results of the evaluation and reasons for ineligibility are documented in the Cultural Resources Class III Survey.

3.7 SOCIOECONOMICS

Prior to the purchase of the land contained within the current Rock Creek Reserve and the proposed Reserve boundary expansion, the primary use of the land was livestock ranching. During the 1800s and the first half of the 1900s the social and economic life of this immediate area depended on the use of this land for grazing. When the U.S. government purchased this land in the 1950s and 1970s it effectively removed the lands within the boundaries of Rocky Flats from agricultural use. In addition, the security and safety aspects of Rocky Flats required termination of incidental use of the land, such as hunting, hiking and horseback riding.

3.7.1 Public Use

Tours of and visits to the Site, including Rock Creek Reserve, are currently arranged and coordinated through the Tours and Visits office in the DOE Office of Communications with significant support from the counterpart contractor organization. Site tours are given on an as needed/as requested basis and often include tours of the Buffer Zone area with its unique natural resources. Types of tours include formal visits by elected officials, DOE officials, and regulatory representatives as well as building or project specific tours for local stakeholders. It is the policy of the Site, in accordance with the DOE Openness Initiative, to accommodate as many requests for Site tours and visits as possible. As DOE continues with cleanup of Rocky Flats, operation of the Tours and Visits function should remain fairly constant. Tours and visits include the Rock Creek Reserve.

3.7.2 Rocky Flats Mission Considerations

The current mission of the Rocky Flats Environmental Technology Site is cleanup and closure. At closure, all nuclear materials and wastes will have been removed from the Site, all buildings will have been demolished, and any remaining contamination will have been remediated per the requirements of RFCA. Current plans call for this mission to be completed late in 2006.

Completion of the closure mission is not expected to directly affect Rock Creek Reserve. However, the continued presence of nuclear material throughout much of the closure project will necessitate continued limitations on unrestricted public access to the Site, including Rock Creek Reserve. In the unlikely event of a nuclear material accident in a facility that could result in significant release of plutonium, the Site's emergency plan is required to consider protective actions for anyone in the buffer zone. (Approval of Site Safety Analysis Report Annual Update, Golan letter, 2000) This may include evacuation and sheltering in order to reduce potential radiological exposures during the accident. Controlling access is a requirement derived from the safety analysis of potential accidents as required by *DOE Order 5480.23, Nuclear Safety Analysis Reports, 1992*.